Review of: "Causality Analysis for Non-Communicable Diseases, Obesity, and Health Expenditure: Toda Yamamoto Approach"

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Potential competing interests: No potential competing interests to declare.

This study aimed to explore the causal relationship between obesity and prevalence of non-communicable diseases (NCDs) in the population and between the burden of NCDs and health expenditure in Turkey. Given the changes observed in the public health of both developed and developing countries, this topic should be viewed as highly relevant. The study's findings show that there is a causal relationship between obesity levels, non-communicable diseases, and health expenditure, as the authors concluded. If we consider obesity as an indicator of the severity of civilizational health risk factors, the existence of such a relationship is quite apparent.

Nevertheless, the approach to the problem's analysis and presentation could be enhanced in the following ways:

1. There is an insufficient number of references to the studied variables within the study. The evolution of the level of obesity risk, burden of non-communicable diseases, and health expenditure during the period under investigation in Turkey is not evident to the reader. The data description does not explicitly indicate that the analyzed relationships apply to Turkey; only the abstract contains such clues.
2. The authors attempt to support the argument that "Obesity is the cause of the burden of non-communicable disease" by performing an econometric analysis of the relationship between the percentage of people in Turkey with a body mass index (BMI) of 30 or higher (which is indicative of obesity) and the total number of years of life lost due to disability (DALY) between 1990 and 2019. The usefulness of these studies may be questioned as the available Global Burden of Disease 2019 data shows that for Turkey, almost 16.5% of the total non-communicable disease burden (measured in DALYs) is due to high body mass index. Since the total DALYs used by the authors in their study of the burden of NCDs are the result of many conditions and risk factors, the simplification applied may lead to substantially incorrect results. Finding the determinants of the total DALY burden requires a broader look at the determinants of health. Similarly, the relationship between DALYs and BMI and the level of health expenditure would require a substantial assessment from the point of view of the health financing algorithm in Turkey.
3. In the introduction, the authors refer to data from 1998 (Kortt, Longley and Cox, 1998) to determine the burden of obesity on health expenditure in the USA, which needs to be updated due to the very progressive nature of the phenomenon.
4. The way the results are presented is incomprehensible. The authors write: "Regarding the association between non-communicable diseases and health expenditures, we have not rejected the first null hypothesis, suggesting that the

> disease burden alone is not the cause of healthcare costs". Then, in the next sentence, they write: "Additionally, we have determined that the disease burden measured in DALY (Disability-Adjusted Life Years) is a contributing factor to healthcare expenditures".

In conclusion, the present article is an important attempt to better understand the relationship between obesity, noncommunicable diseases and health expenditure. However, it needs refinement in the presentation of results, including reference to the public health situation in Turkey. The authors should strengthen the conclusions in the area of identifying the limitations of the model presented, taking into account the health determinants mentioned above. As it stands, the results obtained confirm the existence of the hypothesised association, while the investigation of causality would require a more comprehensive analysis of the interaction mechanisms of the processes studied.